SDMS Document

100004

DECLARATION STATEMENT

RECORD OF DECISION

RADIATION TECHNOLOGY INCORPORATED (RTI)

Site Name and Location

Radiation Technology Incorporated (RTI)
Rockaway Township, Morris County, New Jersey

Statement of Basis and Purpose

This decision document presents the selected remedial action for ground water contamination at the Radiation Technology Incorporated site, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. This decision is based on the administrative record for the site.

The U.S. Environmental Protection Agency, concurs with the selected remedy.

Assessment of the Site

Actual or threatened releases of hazardous substances from the Radiation Technology Incorporated site, if not addressed by implementing the response action selected in this Record of Decision, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

The remedy presented in this document addresses the current and future threats to human health and the environment associated with the contaminated ground water at the Radiation Technology Incorporated site. It provides for the restoration of the contaminated ground water to the more stringent of the federal and New Jersey Safe Drinking Water Act Maximum Contaminant Levels (MCLs) and the New Jersey Ground Water Quality Standards. The need for remediation of contaminant sources will be addressed in a subsequent decision document.

The major components of the selected remedy include:

- Restoration of contaminated ground water to the more stringent of the federal and New Jersey MCLs and New Jersey Ground Water Quality Standards, through extraction of the more highly contaminated ground water and natural attenuation of residual ground water contamination.

- Treatment of the extracted ground water to levels attaining the more stringent of the federal and New Jersey MCLs and New Jersey Ground Water Quality Standards;

- Reinjection of the treated ground water, and
- Appropriate environmental monitoring to ensure the effectiveness of the remedy.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Subsequent actions may be necessary to address contaminant sources at the site.

Because this remedy will result in hazardous substances remaining on site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

for

Robert C. Shinn, Jr.
Commissioner

5/9/94
Date

DECISION SUMMARY
RECORD OF DECISION
RADIATION TECHNOLOGY INCORPORATED (RTI)

SITE NAME, LOCATION, AND DESCRIPTION

The Radiation Technology Incorporated (RTI) site is situated in the western portion of Morris County, New Jersey, at 108 Lake Denmark Road in Rockaway Township (see Figure 1.1). Rockaway Township has a population of approximately 20,000 people. The next closest town to the site is Denville, which has a population of approximately 14,000. Additional population centers in close vicinity of the site (less than 5 miles radius) include Boonton Township, Rockaway Borough, Dover Township, and Wharton Borough. Although no large population center is adjacent to the RTI site, it is immediately northeast of the U.S. Military Picatinny Arsenal facilities, and directly northwest of Lake Telemark, a small residential community.

The area around the RTI site is generally rural in nature. However, there has been significant residential and industrial development in the region. To the west of the site, significant heavy industrial activities have been ongoing at the Army and Navy portions of the Picatinny Military Arsenal facilities since at least the 1920s. Areas to the east of the RTI site consist mainly of single-family residences situated in the population centers mentioned previously. Present land use in the RTI study area is generally considered light industrial.

The RTI site is located within the New Jersey Highlands, which is part of the Reading Prong of the New England physiographic province. In general, the regional topography is characterized by northeastward trenching ridges and parallel valley features with interspersed lakes. The ridges may reach elevations of 1,000 feet or more above Mean Sea Level (MSL) and lowland valleys may drop to elevations of 600 feet or less above MSL.

The topography associated with the New Jersey Highlands is controlled mainly by the structure and lithologic character of the bedrock. In general, the ridges tend to be developed on the more massive and resistant bedrock and the valleys on the less resistant bedrock.

To varying degrees, the topography presently shows the effects of Pleistocene glaciation. A terminal moraine of the Wisconsin glacial stage is situated in the central part of Morris County, New Jersey. The terminal moraine forms a belt which is approximately two to three miles wide and is roughly parallel to the Rockaway River. In general, north of the terminal moraine the topography is moderately rugged and the bedrock is usually well-exposed, except in the valleys. South of the terminal moraine the topography reflects terrain typically associated with glaciation--valleys filled with alluvium and sparse rock exposures.

For the entire 263 acres owned by RTI, elevations range from approximately 950 feet above MSL on a ridge southeast of Lake Denmark road to about 822 feet above MSL along the banks of Lake Denmark.

The entire RTI site consists of 263 acres of land which is comprised of three distinct areas: The active RTI complex, the former Rockaway Industrial Park (RIP) and undeveloped land (see Figure 1.2). The active RTI complex is a 15-acre parcel of land west of Lake Denmark Road on which RTI's industrial operations and facilities are located. The former RIP is an inactive, partially developed 65-acre area situated east of Lake Denmark Road and the active RTI complex. The remaining 183 acres are undeveloped land located primarily north and south of the active RTI complex and former RIP. Background investigations of historical records and surveillance of this undeveloped land did not identify any areas of potential discharge or dumping. Therefore, this area was not included as part of the study area. Remedial investigative work was performed at the active RTI complex (15 acres) and the former RIP (65 acres), thus these two areas are known as the study area.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

The chronology of ownership for the site is:

- -- 1941 to 1963, Reaction Motors, Inc.;
- -- 1963 to 1972, Reaction Motors Division of Thiokol Chemical Corp; and,
- -- 1972 to Present, RTI, Inc.

Past activities of Reaction Motors/Thiokol included testing and development of rocket engines and propellants. RTI's present operation involves low-level irradiation of cosmetics and medical products.

During the period of November 1980 and May 1981, The Department of Environmental Protection and Energy (DEPE) and the Rockaway Township Health Department conducted various inspections of the RTI site. DEPE also conducted investigations into the chemical types and quantities, waste disposal practices and chemical waste characteristics associated with various production and manufacturing processes used at the site.

In March 1981, the Rockaway Township Health Department informed DEPE that it had tested two principal water supply wells on site due to taste and odor complaints from some RTI employees about untreated drinking water on site. Both wells were found to be contaminated with volatile organic compounds (VOCs) and were condemned by the Health Department in June 1981.

As a result of DEPE's investigations, an Administrative Order and Notice of Prosecution were issued to RTI on August 27, 1981, ordering RTI to properly remove and clean up all spills, buried wastes and improperly stored waste materials. DEPE issued a directive to RTI in November 1981 which stated that its activities had contaminated the shallow ground water table with VOCs. The directive further mandated that RTI hire a hydrogeological consultant to determine the degree and extent of the contamination.

In December 1981, RTI responded to DEPE's directive and disclaimed responsibility for the ground water contamination associated with the site. As a result of RTI's failure to comply with the various enforcement and administrative actions issued by the DEPE, the Department filed a verified complaint in March 1982 with the Superior Court of New Jersey, Chancery Division, Morris County. In settlement of the verified complaint, RTI and DEPE entered into a Consent Order in July 1983 under which RTI was required to install six ground water monitoring wells on site.

Subsequent to the Consent Order, six monitoring wells were installed by RTI in September and October of 1983. In September 1983, the RTI site was proposed for inclusion on the National Priorities List (NPL) of Superfund sites. In August 1984, DEPE issued a Site Evaluation Report with the objective of identifying sources of ground water contamination at and around the RTI property. The results of the well sampling and analysis indicated that elevated levels of VOCs were present in the samples analyzed. Subsequently, the RTI site was included on the NPL in September 1984.

In May 1986, DEPE solicited proposals from contractors to perform a remedial investigation/feasibility study (RI/FS) for the RTI site. DEPE issued RTI a directive in June 1986 outlining the findings of DEPE site investigations to date and requiring RTI to pay costs associated with the performance of the RI/FS. In March 1987, RTI entered into an Administrative Consent Order (ACO) with DEPE requiring the company to pay for Phase I of the RI to be performed by a DEPE contractor. In August 1987, DEPE's contractor, Acres International Corporation, initiated the RI/FS.

In addition to the RI/FS, other surveys and remedial work were performed. Radiological surveys were conducted within the 15-acre RTI site under Nuclear Regulatory Commission (NRC) supervision. RTI is licensed by the NRC to possess and use cobalt-60 and cesium-137, both of which NRC regulates pursuant to the Atomic Energy Act. Remediation of all radiologically contaminated soil areas found during the surveys was completed by RTI under NRC direction in two stages during August 1990 and February 1991. Presently, NRC is requiring RTI to monitor ground water through 1995 for radioactive contamination. This data will be submitted to DEPE and EPA for evaluation. NRC and DEPE investigative work to date has not indicated the presence of any radiological contaminants exceeding state and federal ground water standards.

Additional removal actions were conducted by RTI under the direction of DEPE. During July 1990, a leaking underground storage tank containing solvents was excavated and later disposed of off site. Also, RTI performed an interim removal action in May 1993, which included tanks, drums, contaminated soil and sumps, under a separate Memorandum of Agreement (MOA) with DEPE.

In December 1992, RTI and Thiokol Corporation entered into an ACO to reimburse DEPE for the remainder of the RI/FS and to conduct design and remedial activities for contaminated ground water with DEPE oversight.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

A Community Relations Plan (CRP) was developed to ensure the public opportunities for involvement in site-related decisions, including site analysis and characterization, alternatives analysis, and remedy selection. In addition, the CRP was used by DEPE and EPA to determine, based on community interviews, activities to ensure public involvement and to provide opportunities for the community to learn about the site.

A meeting was held in May 1987 to provide residents and local officials with an update on past activities and to inform the public of current and future activities planned for the site.

The RI/FS reports, which addressed the ground water contamination, were released to the public in July 1993. A Proposed Plan, that identified EPA's and DEPE's preferred remedial alternative, was also released in July 1993. The documents were made available to the public at an information repository maintained at Rockaway Township Public Library. A public comment period was held from July 30 through September 27, 1993. A public meeting was held on August 11, 1993, to present the findings of the RI/FS and the Proposed Plan, and to solicit public comment. A notice of the public comment period and public meeting was published in the July 30, 1993 edition of the "The Record" (Morristown). The issues raised at the public meeting and during the public comment period are addressed in the Responsiveness Summary, which is part of this Record of Decision (ROD).

SCOPE AND ROLE OF ACTION

This ROD presents the selected ground water remedial action for the RTI site, chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and

Hazardous Substances Pollution Contingency Plan (NCP) and the Industrial Site Recovery Act, P.L. 1993, c. 139 (S-1070). The selection of the remedy described in this ROD is based upon documentation comprising the administrative record.

This document solely addresses remediation of the contaminated ground water at the RTI site. Potential ingestion of contaminated ground water at the site presents a risk to human health because DEPE's and EPA's acceptable risk range is exceeded and the concentrations of various contaminants in ground water exceed State Ground Water Quality Standards (NJAC 7:9-6) (GWQS) and federal Maximum Contaminant Levels (MCLs). Remedial alternatives have been developed which address contaminated ground water and focuses on the protection of human health and environment. Information obtained during the Phase I and II Remedial Investigation also identified potential source areas of contamination, i.e. soils, sumps, tanks and drums. As previously noted, RTI performed an interim removal action to address potential source areas of contamination to meet DEPE's current non-residential requirements for polychlorinated biphenyls and inorganic compounds in soil, while VOC levels in the soil were below state action levels for remediation. The need for any further remedial action in the source areas will be addressed under a separate ROD.

SUMMARY OF SITE CHARACTERISTICS

The RI for the study area was conducted in three phases. During 1987, the Phase I RI concentrated on the 15-acre active RTI complex. The Phase II RI included the 65-acre former RIP as well as the active RTI complex and was conducted in 1989 and 1990. Data gaps were identified in the RI report by DEPE and provided the basis for a supplemental Phase II investigation conducted in July 1992.

The study area is located within two sub-basins of the Rockaway River drainage basin. Most of the study area to the east of Lake Denmark Road, including most of the former RIP, drains to the south and is in a drainage basin that includes Lake Telemark, Lake Ames, and Beaver Brook. The study area to the west of Lake Denmark Road, including the active RTI complex, drains to the west and is in a drainage basin which includes Lake Denmark, Lake Picatinny, and Green Pond Brook.

From a geologic perspective, the study area is underlain by three lithologic units: glacial till, saprolite and crystalline bedrock. Ground water is present within two distinct hydrostratigraphic units: the glacial till/upper saprolite (overburden) and bedrock units, referred to as the overburden water bearing zone and bedrock aquifer, respectively.

The overburden water bearing zone is a shallow unit limited to the active RTI complex and the extreme southern portion of the former RIP. A bedrock aquifer is present throughout the entire study area and locally serves as the source of water for domestic and industrial wells. Horizontal flow direction varies according to the geohydrologic basin--two such basins exist at the RTI site. Ground water recharge zones are present in areas of higher elevation. Ground water discharge occurs in proximity to Lake Denmark and adjacent wetlands or to the on-site intermittent stream which flows to Lake Telemark.

Contamination is present in both the overburden water bearing zone and bedrock aquifer. Concentrations of volatile organic, semi-volatile and inorganic compounds exceed state GWQS and federal MCLs. The ground water is classified as Class IIA and the primary designated use for this class is potable water. Results of both RI phases confirm that contamination in the overburden water bearing zone is variable and localized, creating a sporadic distribution pattern.

The VOCs detected in the overburden water bearing zone with maximum concentrations above the state GWQS and federal MCLs included: acetone; 1,1,1-trichloroethane (1,1,1-TCA); 1,1-dichloroethane (1,1-DCA); 1,1,2-trichloroethane (1,1,2-TCA); trichloroethene (TCE); 1,1-dichloroethene (1,1 DCE); tetrachloroethene (PCE); carbon tetrachloride; chloroform; and, methylene chloride (see Table 1.1). Bis(2-ethylhexyl) phthalate was the only semi-volatile organic compound detected at levels above state GWQS and federal MCLs. Lead and chromium (total) were detected sporadically in the overburden water bearing zone at 18 micrograms per liter (ug/L or parts per billion) and 167 ug/L, respectively, marginally above state GWQS (5 ug/L and 100 ug/l) and federal MCLs (15 ug/l and 100 ug/L).

In general, the bedrock aquifer exhibited higher levels of ground water contamination than the overburden water bearing zone primarily due to halocarbons (see Table 1.2). During the Phase I RI, VOC contamination was found in every bedrock well. The total VOC concentrations ranged from 1 ug/L to 2,003 ug/L. Aside from acetone, the primary contaminants were 1,1,1-TCA, TCE, carbon tetrachloride and the degradation products of these compounds.

Due to the installation and sampling of additional wells during Phase II RI, the horizontal extent area of ground water contamination was defined. Phase II RI results documented that VOCs were the major contaminants present in the bedrock aquifer. On the active RTI complex, halocarbons, freons and acetone were the primary VOCs present. Total VOC concentrations ranged from 7 ug/L to 7,600 ug/L. TCE concentrations exceeded the 1 ug/L state GWQS and 5 ug/L federal MCL; the maximum concentration detected was 140 ug/L. The vinyl chloride concentration in one well was 99 ug/L, which exceeded the 0.08 ug/L state GWQS. Carbon tetrachloride levels were over the 0.4 ug/L state GWQS. Geographically, these contaminant groups are distributed from the active RTI facility to the west and south toward the RTI property boundary with Picatinny Arsenal. The highest concentrations are generally present within the RTI active portion of the site, where the total concentration of VOCs range up to an excess of 13,000 ug/L. Freon, a Dense Non-Aqueous Phase Liquid (DNAPL), is the most significant contributor to this high concentration of VOCs. Although the levels of freon detected at the study area were below health based criteria developed by DEPE consistent with state GWQS, the Department is concerned with the possibility that Freon-113 (1,1,2-trichloro-1,2,2-trifluoroethane) exists in the bedrock aquifer in concentrations indicative of free product.

During the supplemental Phase II RI performed during July 1992, packer pump tests were performed on the intake portion of a formerly used production well behind the active RTI facility. The testing indicated that sufficient flow could be obtained from the bedrock aquifer to allow for installation of a ground water pump and treatment system.

VOCs detected in the bedrock aquifer during the supplemental Phase II RI with maximum concentrations above state GWQS and federal MCLs included: acetone; 1,1,1-TCA; 1,1-DCA; 1,1,2-TCA; TCE; 1,1-DCE; 1,2-dichloroethylene [total] (1,2-DCE [total]); PCE; vinyl chloride; carbon tetrachloride; chloroform; methylene chloride; benzene; and, chlorobenzene (see Figures 1.1 and 1.2). Bis(2-ethylhexyl) phthalate and 2-chlorophenol were the only semi-volatile organic compounds detected in the bedrock aquifer at levels above state GWQS and federal MCLs. Lead, silver and aluminum were detected sporadically in the bedrock aquifer at concentrations marginally above the standards.

During the Phase II RI, five residential wells were sampled close to the study area. None of the wells exhibited contamination with target VOCs and heavy metals. (One exception was the lead concentration in well RW-01 which was measured at 496 ug/L, above the 5 ug/L state GWQS. However, the lead contamination is considered to be non-site related because the range of lead concentrations detected in bedrock wells on site were considerably lower, 4.3 ug/L to 14.1 ug/L. It should be noted that re-sampling of RW-01 resulted in a 5 ug/L measurement.) To reaffirm these findings, another round of residential well sampling will be scheduled during the design phase.

The analytical results for ground water samples collected from monitor wells located along the abandoned railroad bed adjacent to Lake Denmark were compared to DEPE and EPA in-stream criteria to evaluate the potential impacts of contaminated ground water on Lake Denmark water quality. This criteria of evaluating potential impacts of contaminated ground water on surface water bodies is consistent with state GWQS. Values for TCE (140 ug/L, 18 ug/L, and 91 ug/L) and carbon tetrachloride (87 ug/L, 4.8 ug/L, and 47 ug/L) exceeded the state and federal in-stream criteria of 1 ug/L and 2 ug/L, respectively. Levels of chloroform (8 ug/L) and 1,1-DCE (27 ug/L) exceeded the criteria of 6 ug/L and 5 ug/L, respectively. Concentrations 1,1,2-TCA (14 ug/L) exceeded the criteria of 10 ug/L. In MW-18D, 1,1,1-TCA (150 to 240 ug/L) exceeded the criteria of 30 ug/L. The concentration of bis(2-ethylhexyl) phthalate (2782 ug/L) exceeded the criteria (2 ug/L) in one well only. These contaminant values, with the exception of chloroform, also exceed state remedial surface water discharge standards derived from DEPE's "Technical Manual for Discharges to Surface Water" (July 1993).

During the Phase II RI surface water and sediment samples were taken in the Lake Telemark drainage area. Surface water analyses revealed the presence of the following metals: cadmium (11 ug/L), copper (150 ug/L), aluminum (3,253 ug/L), lead (158 ug/L) and zinc (133 ug/L). All levels exceed DEPE Surface Water Quality Criteria with the exception of aluminum for which no criteria exist. Sediment samples showed lead in the range of 6.3 micrograms per kilogram (mcg/kg or parts per billion) to 116 mcg/kg and zinc, 28.4 mcg/kg to 792 mcg/kg. Since the metals noted above were not part of processes used by businesses operating at the site nor found to any great extent near source areas of other contamination on site, these metals are not considered site related.

Sediment sampling of Lake Denmark was conducted as part of the supplemental Phase II RI to determine whether contaminants were entering the lake. Compounds detected included: 1,1 DCA; 1,2 DCE (total); 2 butanone; TCE; Freon 113; 1,2, dichloro-1,1,2 trifluoroethane; acetone; and, toluene. Acetone and toluene were detected at the highest concentrations of 1,600 mcg/kg and 4,200 mcg/kg, respectively. Since these constituents were found in monitoring wells on site and based on the direction of ground water flow, it is believed that ground water contamination is entering the lake from the RTI site.

SUMMARY OF SITE RISKS

Based upon the results of the RI, a baseline risk assessment was conducted to estimate the risks associated with current and future site conditions. The baseline risk assessment estimates the human health and ecological risk which could result from the contamination at the site if no remedial action were taken. The analysis assists in evaluating whether remediation is necessary.

HUMAN HEALTH RISK ASSESSMENT

The purpose of performing a Human Health Risk Assessment is to evaluate current and potential threats posed by uncontrolled hazardous substance releases. A four-step process is used for assessing site-related human health risks:

Hazard Identification - identifies the contaminants of concern at the site based on several factors such as toxicity, frequency of occurrence, and concentration.

Exposure Assessment - estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., ingesting contaminated well water) by which humans are potentially exposed. The reasonable maximum exposure (RME) is used as the highest exposure that could reasonably be expected to occur for a given exposure pathway at a site.

Toxicity Assessment - determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response).

Risk Characterization - summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative (e.g., one-in-a-million excess cancer risk) assessment of site-related risks. An evaluation of the uncertainty surrounding the quantitative estimate is useful for making risk management decisions.

The baseline risk assessment began with selecting contaminants of concern which would be representative of site risks. The primary contaminants of concern are 1,1,1-TCA, TCE, Freon-113, vinyl chloride, 1,1-DCE, carbon tetrachloride and associated degradation products. Most of these contaminants of concern listed above are known or are suspected of causing cancer in animals and/or humans. The baseline risk assessment quantitatively evaluated the health effects which could result from ingestion of untreated ground water by residents and inhalation of VOCs by residents while showering with untreated ground water. Based on the current usage and hydrogeology of the site, and on the results of analyses performed on ground water samples collected from local residential wells, exposure to VOC contaminants is not believed to be occurring and was not evaluated under current site conditions. Residential wells are considered to be side and up-gradient of the RTI site in terms of the direction of predominant ground water flow. However, since the most significant ground water contamination exists in the bedrock aquifer and flow within bedrock aquifers is often difficult to predict due to variable fractures, no assurance exists that nearby wells will not be impacted in the future.

Site ground water is part of an aquifer that serves as the sole drinking water source for area residents. As a result, it is possible that residents could elect to install private drinking water wells in the future in areas affected by site contaminants. Therefore, future ingestion of ground water by residents was evaluated. In addition, exposure via ingestion of ground water by RTI employees may also occur under future site conditions. However, because the exposure to employees is of short duration, compared to potential residential exposure, this work-related scenario is expected to be less significant and was not evaluated quantitatively.

Due to the potential use of ground water in the future in areas affected by site contaminants, residents may also be exposed via dermal contact with and inhalation of contaminants in ground water. Exposure is expected to occur primarily through bathing, showering and/or cooking. Exposure via dermal contact with and inhalation of contaminants in ground water by site employees may also occur but is expected to be less significant than future exposure to residents due to shorter and less frequent exposure.

The inhalation of contaminants volatilizing from ground water seeping into basements is not expected to occur due to the depth of ground water (20 to 30 feet) in adjacent residential areas and in areas potentially developed for residential use. In addition, the RTI facility does not have any areas that were constructed below ground surface. As a result, exposure via this pathway is assumed to be insignificant and is not evaluated.

EPA's allowable cancer risk range is 10^{-4} to 10^{-6} which can be interpreted to mean that an individual may have the probability of approximately one in ten thousand to one in a million increased chance of developing cancer as a result of site-related exposure to a carcinogen during a 70-year lifetime under the specific exposure conditions at the site. DEPE's allowable cancer risk is one in one million (10^{-6}) based on P.L. 1993, c.139, Section 35d (S-1070).

The potential carcinogenic risk value associated with the ingestion of ground water was estimated to be 3×10^{-3} (or three in 1,000) which exceeds the acceptable risk range established by EPA (1×10^{-4}, one in 10,000 to 1×10^{-6}, one in a million) (see Table 2.1 - Summary of Carcinogenic Risk Estimated for the Radiation Technology Site). This value is attributable primarily to the presence of vinyl chloride which was detected at 99 ug/L. Maximum detected concentrations of 1,1-DCE (21 ug/L) and carbon tetrachloride (140 ug/L) detected in samples also contributed to the total elevated risk estimate with chemical-specific risk estimates of 1×10^{-4} and 2×10^{-4}, respectively.

For a ground water dermal contact scenario for future residents, the total risk value was estimated to be 2×10^{-4}. This value was primarily due to the presence of carbon tetrachloride, 1,1-DCE and vinyl chloride.

The risk value for the inhalation of ground water contaminants through shower vapors by residents under a future use scenario was estimated to be 4×10^{-4}. This was mainly attributed to the concentrations of 1,1-DCE and vinyl chloride, which both had risk values of 2×10^{-4}. (See attached risk tables - Summary of Carcinogenic and Non-carcinogenic Risk).

To assess the overall potential for non-carcinogenic effects posed by more than one contaminant, EPA has developed a hazard index (HI) (see Table 2.2 - Summary of Non-Carcinogenic Risk Estimated for the Radiation Technology Site). This index measures the assumed exposures to several chemicals at low concentrations, simultaneously, which could result in adverse health effects. In accordance with this approach, a hazard quotient (HQ), i.e., the ratio of the level of exposure to an acceptable level, greater than 1.0 indicates that the exposure level exceeds the protective level for that particular chemical. Also, if the hazard quotients for individual chemicals are less than 1.0, but the sum of the hazard quotients for all substances in an exposure medium (i.e., the hazard index is greater than 1.0), there may be a concern for potential health effects. Furthermore, the HI is summed for all media common to a particular receptor.

A chronic HI of 10 for the ingestion of unfiltered ground water by future residents was high mainly due to the presence of carbon tetrachloride and manganese, whose HQs exceeded unity. Although carbon tetrachloride was infrequently detected (in three out of 21 samples analyzed), manganese was detected in all samples analyzed. Ten contaminants (1,1,1-TCA, 1,2-DCE [total], acetone, chlorobenzene, ethylbenzene, TCE, aluminum, arsenic, iron, and nickel) had HQs between 1 and 0.5. The remaining 12 contaminants for which daily exposure doses were calculated had HQs less than 0.1.

The HI for the ground water dermal contact scenario for future residents exceeded unity (2). This was mainly attributed to the presence of carbon tetrachloride (HQ=1) at a maximum concentration of 140 ug/L. Sufficient toxicity information was available to calculate HQs for 24 other contaminants, all of which had HQs less than 0.1.

The HI for the inhalation of ground water contaminants through shower vapors by residents under a future use scenario was less than one (0.4). Therefore, exposure from this scenario is not expected to pose a significant non-carcinogenic risk.

Actual or threatened releases of hazardous substances from the RTI site, if not addressed by implementing the response action selected in the Record of Decision, may present an imminent and substantial endangerment to public health, welfare or the environment.

ECOLOGICAL RISK ASSESSMENT

As part of the Ecological Risk Assessment, a qualitative and/or semi-quantitative appraisal of the actual or potential effects of a hazardous waste site on plants and animals is performed. A four-step process is used for assessing site-related ecological risks:

Problem Formulation - a qualitative evaluation of contaminant release, migration, and fate; identification of contaminants of concern, receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study.

Exposure Assessment - a quantitative evaluation of contaminant release, migration, and fate; characterization of exposure pathways and receptors; and measurement of estimation of exposure point concentrations.

Ecological Effects Assessment - literature reviews, field studies, and toxicity tests, linking contaminant concentrations to effects on ecological receptors.

Risk Characterization - measurement or estimation of both current and future adverse effects.

This ecological risk assessment describes the terrestrial and aquatic habitats and species that have been noted or are expected to be present at the RTI property and evaluates the potential risks associated with the exposure of these biota to contaminants detected during the RI. The objective of this risk assessment was to evaluate whether contaminants present at the RTI property may pose adverse impacts to biota present in habitats on the site or adjacent to the site. Quantitative measures to evaluate ecological risks (e.g., wildlife population inventories, biota sampling, bioassays, and predictive modelling) were not within the scope of this risk assessment.

The RI identified surface water concentrations of copper within a small intermittent stream leading from the active RTI facility to Lake Denmark which may result in potential acute and chronic impacts to aquatic biota inhabiting this stream. Cyanide and zinc concentrations also contribute to risk within the Lake Denmark drainage area surface waters. Sediment contaminants within the Lake Denmark drainage area that may result in adverse impacts to sensitive aquatic biota include 4,4-DDT (and its derivative 4,4-DDE) and antimony. Concentrations of barium, copper, iron, lead, manganese, mercury, and silver may also impact biota (particularly species sensitive to contaminants) inhabiting aquatic environments present within this area. However, most of these metals may be naturally occurring as noted by the fact that this site was part of the Dover Mining District that was heavily mined earlier this century. Based upon knowledge of past activities at the RTI site, barium is the only metal of those mentioned above that may have been discharged due to industrial activities.

Although sediments within Lake Denmark contain a variety of VOCs, concentrations are not likely to result in acute or chronic impacts to aquatic organisms inhabiting this environment. Mean concentrations of all VOCs are below levels shown to cause acute and chronic ecological effects. Sampling of additional contaminants that are generally more toxic (e.g., pesticides and inorganics) was not conducted during the RI because they are not believed to have been discharged due to industrial activities. Additional sampling of surface water and sediments in an expanded area of Lake Denmark for VOCs and other site related compounds will be conducted during the design phase.

Surface water concentrations of copper, cadmium, aluminum, lead, and zinc may result in potential acute and chronic impacts to aquatic biotas inhabiting the streams within the Lake Telemark drainage area. These metals may be naturally occurring as previously mentioned. Potential acute impacts are particularly likely within an area of emergent marsh where the highest concentrations of several inorganics were noted. Although surface water concentrations of Aroclor-1260, antimony, iron, and mercury may also contribute to chronic risk, each of these contaminants (except iron) was detected infrequently; therefore, widespread exposure to aquatic organisms is unlikely.

Although acute and chronic impacts from organic sediment contaminants within the Lake Telemark drainage area are not expected to occur, concentrations of barium, iron, lead, manganese, and zinc may result in adverse effects to aquatic organisms. However, these constituents are not believed to be site related.

SUMMARY OF REMEDIAL ALTERNATIVES

CERCLA requires that each selected site remedy be protective of human health and the environment, be cost effective, comply with other statutory laws, and use permanent solutions, alternative treatment technologies, and resource recovery alternatives to the maximum extent practicable. The FS report evaluates in detail six remedial alternatives for addressing the contamination associated with the RTI study area, Table 3 presents a "Summary of Costs of Alternatives." The estimated capital cost, operation and maintenance (O&M) cost, and net present worth cost for each alternative discussed below are provided for comparison.

These alternatives are:

Alternative 1GW - No Action

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Net Present Worth Cost: $41,000
Estimated Implementation Timeframe: 0

The no action alternative provides a baseline for comparison to other remedial options. Under this alternative no remedial action would be taken. After five years a review would be conducted to determine if any remedial action is necessary.

Alternative 2GW - Institutional Control

Estimated Capital Cost: $228,000
Estimated Annual O&M Cost: $94,000
Estimated Net Present Worth Cost: $2,122,000
Estimated Implementation Timeframe: 30 Years

Alternative 2GW is composed of four components: increased public awareness; design, installation and semi-annual sampling of a sentinel well system (on-site monitor wells located near the perimeter of the site to provide an early warning of potential plume migration toward residential areas); quarterly sampling of selected on-site monitor wells; and, semi-annual sampling of selected residential wells.

The elements of this alternative have been assumed to be implemented for a period of 30 years in the FS. The status of the nature and extent of the ground water contamination would be assessed every year. Every five years, the site status would be evaluated and the need for continued or additional remedial action would be addressed.

Alternative 3GW - Ground Water Collection with Hydrofracturing and Air Stripping Treatment

Estimated Capital Cost: $486,000
Estimated Annual O&M Cost (Years 1 to 5): $140,000
Estimated Annual O&M Cost (Years 6 to 10): $108,000
Estimated Net Present Worth Cost: $1,963,000
Estimated Implementation Timeframe: 10 years

This alternative addresses the area of highest ground water contamination using pump and treat technology. Alternative 3GW consists of these major components: increased public awareness; design, installation and semi-annual sampling of a sentinel well system; quarterly sampling of selected site on-site monitor wells; semi-annual sampling of selected residential wells; provision for point-of-entry treatment (POET) units for potable wells; and, design and installation of a ground water pump and treat system which includes air stripping and carbon treatment of the off gases. The number and location of recovery wells and the need to hydrofracture bedrock could change based on the actual design. Treatment efficiency for air stripping is 99.5 percent for removal of chlorinated hydrocarbons. Gases released during this process will be treated with a vapor phase carbon treatment unit and air emissions will comply with ARARs.

Residual contamination in the ground water beyond the capture zone would dissipate through natural attenuation; the length of time for this process to occur is uncertain and not incorporated into the 10-year timeframe under this alternative nor in its present worth cost.

This alternative reinjects treated effluent to the overburden water bearing zone. The extracted ground water will be treated to meet effluent standards based on state GWQS and federal MCLs. Discharge of treated effluent to adjacent wetlands and Lake Denmark have been retained as options in case discharging to the overburden water bearing zone is not possible. If this occurs, the discharge will meet DEPE Surface Water Quality Criteria and federal Ambient Water Quality Criteria.

At the proposed pulse-pumping rate, one pore volume of ground water in the most contaminated area would be removed in one half year. It is estimated that the removal of 10 pore volumes in 5 years time would be sufficient to reduce contaminant concentrations to levels meeting state GWQS and federal MCLs. This timeframe will be optimized during design and subsequent operation. Ground water monitoring will continue for five years after completion of the pump and treat phase of this alternative to confirm the results.

Alternative 4GW - Ground Water Collection with Hydrofracturing and H_2O_2/UV Treatment

Estimated Capital Cost: $704,000
Estimated Annual O&M Cost (Years 1 to 5): $233,000
Estimated Annual O&M Cost (Years 6 to 10): $108,000
Estimated Net Present Worth Cost: $2,800,000
Estimated Implementation Timeframe: 10 years

Alternative 4GW is identical to Alternative 3GW described previously except Hydrogen Peroxide (H_2O_2)/Ultraviolet (UV) treatment has been substituted for air stripping. Treatment efficiency for H_2O_2/UV is 98 percent for removal of chlorinated hydrocarbons.

Alternative 5GW - Ground Water Collection and Air Stripping Treatment without Hydrofracturing

Estimated Capital Cost: $457,000
Estimated Annual O&M (Years 1 to 9): $128,000
Estimated Annual O&M (Years 10 to 14): $108,000
Estimated Net Present Worth Cost: $2,241,000
Estimated Implementation Timeframe: 14 years

Alternative 5GW is identical to Alternative 3GW except wells P-6, R-1 and 14D would not be hydrofractured to increase well yields.

The wells would be pulse pumped at a rate to be determined during the design phase. The decrease in well yields from P-6, R-1 and 14D increases time of operation nearly five years and present worth costs by approximately $300,000.

Alternative 6GW - Complete Aquifer Restoration with Hydrofracturing and Air Stripping Treatment

Estimated Capital Cost: $1,015,000
Estimated Annual O&M Cost (Years 1 to 14): $207,000
Estimated Annual O&M Cost (Years 15 to 19): $108,000
Estimated Net Present Worth Cost: $4,445,000
Estimated Implementation Timeframe: 19 years

The objective of this alternative is to actively restore the entire contaminated bedrock aquifer to comply with state GWQS and federal MCLs. Trichloroethene and its associated compounds are the most critical contaminants because they affect the largest portion of the study area and require remedial action at very low concentrations. The three recovery wells described in Alternative 3GW will be supplemented with seven down-gradient perimeter wells. The system would operate under a pulse-pump regime and extracted ground water would be treated by an air stripper system. H_2O_2/UV was dropped as a treatment system for this alternative because it is less efficient and more costly than air stripping. Gases released during this process will be treated with a vapor phase carbon treatment unit. With each recovery well being hydrofractured, a sustained pumping rate of approximately 170 gpm will extract 50 pore volumes of the contaminated plume in 14 years.

Effluent will be treated to meet state GWQS and federal MCLs and will be reinjected into the overburden water bearing zone, or if necessary, discharged to Lake Denmark or into adjacent marshes, where such discharge will meet state and federal surface water quality standards.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

During the detailed analysis of remedial alternatives, each alternative is assessed against nine evaluation criteria: overall protection of human health and the environment; compliance with applicable or relevant and appropriate requirements (ARARs); long-term effectiveness and permanence; reduction of toxicity, mobility or volume; short-term effectiveness; implementability; cost; state/support agency acceptance; and, community acceptance.

The evaluation criteria are described below:

Overall Protection of Human Health and the Environment: This criterion addresses whether or not a remedy provides adequate protection and describes how risks are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Compliance with ARARs: This criterion addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other environmental statutes and requirements or provide grounds for a waiver.

Long-term Effectiveness Permanence: This criterion refers to the ability of a remedy to maintain protection of human health and the environment, once cleanup goals have been met.

Reduction of Toxicity, Mobility or Volume through Treatment: This criterion refers to the anticipated performance of the treatment technologies a remedy may employ.

Short-term Effectiveness: This criterion considers the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

Implementability: This criterion examines the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

Cost: This criterion includes capital and operation and maintenance costs.

State/Support Agency Acceptance: This criterion indicates whether, based on its review of the RI/FS report and Proposed Plan, DEPE or EPA concurs, opposes or has no comment on the selected remedy.

Community Acceptance: This criterion refers to the public's general response to the alternatives described in the Proposed Plan and the RI/FS reports. Responses to public comments are addressed in the Responsiveness Summary of the ROD.

The following is a comparative analysis of the alternatives based upon the evaluation criteria noted above.

Overall Protection of Human Health and the Environment

With regard to existing receptors, all treatment alternatives evaluated provide protection of human health and the environment. The results of the quantitative risk assessment for the RTI study area indicated that chemical contaminants in site ground water do not pose a present threat to human health or the environment.

With regard to potential risk to future receptors, all treatment alternatives provide protection to human health or the environment.

Under certain future conditions, where new and existing residential wells are impacted by site ground water contamination, Alternatives 3GW, 4GW, 5GW, and 6GW would provide protection through treatment of extracted ground water.

Alternatives 3GW, 4GW, and 5GW provide protection through treatment of ground water extracted from the most contaminated portion of the aquifer near the active RTI facilities. These ground water collection systems would recover a majority of the contamination including vinyl chloride which is the contaminant of concern that poses a significant risk under future scenarios. Residual contamination in the ground water beyond the capture zone will dissipate through natural attenuation.

Alternative 6GW provides protection through complete aquifer restoration. Under this system, contaminated ground water would be collected at the most contaminated portion of the aquifer and at the down-gradient edge of the contaminant plume. No additional protection to human health and the environment is provided under this alternative than what would be provided under Alternatives 3GW, 4GW and 5GW, according to risk assessment data. Furthermore, due to the complex nature of the bedrock aquifer and the wide dispersion of contaminants, it is not known if complete aquifer restoration is technically feasible at this time.

Disposal of treated ground water under Alternatives 3GW through 6GW would be protective of the environment because required discharge standards will be met. Air emissions from the air stripper/vapor phase carbon treatment system under Alternatives 3GW, 5GW and 6GW will not exceed the standards set by state and federal agencies.

Compliance with ARARs

The three types of ARARs used throughout this evaluation include: chemical-specific ARARs which are the criteria used for the remediation goals; location-specific ARARs which restrict activities because they are located within sensitive areas such as floodplains, wetlands or historical areas; and, action-specific ARARs which are part of the remedial action such as discharge criteria for ground water.

Active remediation of the entire plume under Alternative 6GW would remediate the contaminated ground water across the entire site to chemical-specific ARARs in the shortest period of time. Alternatives 3GW, 4GW and 5GW would require a longer period of time to attain chemical-specific ARARs across the entire site as they combine natural attenuation with active remediation of the most contaminated portion of the plume.

All treatment alternatives would comply with action-specific ARARs by meeting ground water discharge criteria and air emissions criteria. Also, the alternatives would comply with location-specific ARARs.

The specific ARARs for the selected remedy are listed below:

Action-specific ARARs:

- Federal Hazardous Waste Manifest Requirements for Off-site Waste Transport (40 CFR Part 262)
- Department of Transportation (DOT) Rules for Hazardous Materials Transport (49 CFR Part 268)
- Resource Conservation and Recovery Act (RCRA) Land Disposal Restrictions Material Response (29 CFR Parts 1904, 1910, 1926)
- Clean Water Act Water Quality Criteria (40 CFR Part 131)
- Clean Air Act National Ambient Air Quality Standards, 940 CFR Part 50)
- New Jersey Safe Drinking Water Act Maximum Contaminant Levels (NJAC 7:10)
- Safe Drinking Water Act (SDWA) National Primary Drinking Water Regulations (40 CFR Parts 141, 142, and 143)
- New Jersey Water Pollution Control Act Standards for Groundwater (NJAC 7:14 A-6:15)
- New Jersey Water Pollution Discharge Elimination System (NJAC 7:14A)
- New Jersey Air Pollution Control (NJAC 7:27-5, 13,16 and 17)
- National Pollution Discharge Elimination System (40 CFR 122 and 125)
- Standards for Hazardous Waste Transporters (40 CFR 263)
- Noise Pollution (NJAC 7:29-1)
- P.L. 1993, c.139 (S-1070)

Chemical-specific ARARs:

- Safe Drinking Water Act (SDWA), MCLs and MCL Goals (40 CFR Part 141)
- Clean Water Act Water Quality Criteria (40 CFR Part 131)
- Clean Air Act National Ambient Air Quality Standards, (40 CFR Part 50)
- New Jersey Safe Drinking Water Act Maximum Contaminant Levels (NJAC 7:10)
- New Jersey Water Pollution Control Act Standards for Groundwater (NJAC 7:9-6; NJAC 7:14 A-6:15)
- New Jersey Water Pollution Discharge Elimination System (NJAC 7:14)
- New Jersey Air Pollution Control (NJAC 7:27-5, 13, 16 and 17)
- National Pollution Discharge Elimination System (40 CFR Parts 122 and 125)
- Standards for Hazards for Hazardous Waste Transporters (40 CFR Part 263)
- National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61)
- P.L. 1993, c.139 (S-1070)

Location-Specific ARARs

- Clean Air Act National Ambient Air Quality Standards, 40 CFR Part 50
- 40 CFR Part 6 Appendix A (Regulations for implementing Executive Order 11990--Protection of Wetlands)
- Clean Water Act, 33 U.S.C. 1344
- Executive Order 11988--Floodplain Management

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives 3GW, 4GW, 5GW and 6GW would satisfy this criterion. Each alternative employs treatment that is capable of removing the VOC contaminants from the extracted ground water thereby reducing the mobility of the contaminant plume. Ground water treatment with air stripping and vapor phase carbon Alternatives 3GW, 5GW, and 6GW would create spent carbon that would need to be sent off-site for disposal or regeneration. Alternative 4GW, using H_2O_2/UV treatment, would generate no residuals. Alternative 6GW would provide the greatest reduction in mobility of contaminants. Alternatives 1GW and 2GW would not reduce the mobility of the contaminant plume.

Long-Term Effectiveness and Permanence

Alternative 6GW provides the best long-term effectiveness and permanence because it proposes to recover and treat the entire contaminant plume. Some residual contamination will remain within the aquifer at levels below ARARs and will dissipate through natural attenuation without endangering human health and the environment.

Alternatives 3GW, 4GW, and 5GW recover and treat the most contaminated portion of the aquifer. Residual contamination at higher levels and in a greater area than those in Alternative 6GW would remain, but would eventually dissipate through natural attenuation.

All ground water treatment options would provide long-term effectiveness and treatment of VOC contaminants. Alternatives 1GW and 2GW are neither effective nor permanent.

Short-Term Effectiveness

Alternatives 1GW and 2GW are the least disruptive to the current operations, existing use of land and the environment. Only the installation of off-site monitor wells and sampling events would be performed in the area under 2GW. Construction time required to install the proposed monitor wells would be approximately one month.

Alternatives 3GW, 4GW, 5GW, and 6GW would be somewhat disruptive to the current operations and existing conditions since these alternatives involve the construction of recovery wells and treatment facilities. These alternatives could also threaten the well yield at active production well P-2 and therefore the water supply to RTI during ground water recovery operations near the RTI facility. Overall construction time for these alternatives is about one year.

No impacts to human health and the environment from construction and implementation of the alternatives are expected.

Implementability

The design and construction of all the alternatives is expected to require about two years. Alternative 2GW would require about one year.

Alternatives 3GW, 4GW, 5GW, and 6GW require the installation of buried piping on the active portions of the RTI facility. The location of building foundations and utilities would need to be located during the design. To ensure that adequate well yields can be realized from the proposed recovery wells, a pump test will be required during the design phase.

Air stripping and vapor phase carbon adsorption technologies included in Alternatives 3GW, 5GW and 6GW are proven technologies and easily implemented. Conversely, H_2O_2/UV included in 4GW is a new technology for treatment and destruction of ground water contaminants and not as readily available.

The remedies which involve active pumping and treating of contaminated ground water will attempt to remove or control DNAPL sources where practicable. This approach will limit further contamination of ground water. These remedies are consistent with EPA's Office of Solid Waste and Emergency Response Directive 9236.2-25 "Guidance for Evaluating the Technical Impracticability of Ground Water Restoration."

Cost

Alternative 1GW requires a review after five years and has a present worth cost (PWC) of $41,000. Alternative 2GW consists of installing four new sentinel wells, expanding three existing monitor wells and sampling on-site and off-site conditions. Alternative 2GW has a PWC of $2,122,000 over 30 years. Alternative 3GW consists of extracting the most highly contaminated ground water from the bedrock aquifer and treating with air stripping technology. The PWC for Alternative 3GW is $1,963,000 and would be implemented for 10 years. Alternative 4GW is identical to Alternative 3GW except that H_2O_2/UV technology is substituted for air stripping to treat extracted ground water. The PWC for Alternative 4GW is $2,800,000 and would be implemented for 10 years. Alternative 5GW has the same components as Alternative 3GW except the recovery wells are not hydrofractured to increase well yields. The lower yields result in a longer implementation period, about 14 years, and an increased PWC of $2,241,000. The goal of Alternative 6GW is restoration of the bedrock aquifer using 10 recovery wells and air stripping technology. The PWC of Alternative 6GW is $4,445,000 and would be implemented for 14 years.

Under the provisions of P.L. 1993, c.139, Section 35g relating to remedial costs, DEPE cannot require a responsible party to implement a permanent remedy at a contaminated site if a non-permanent remedy can be implemented for less than half the cost. Of the alternatives presented in this ROD, the non-permanent remedy 3GW is less than 50 percent of the cost of the permanent remedy 6GW. Consequently, DEPE cannot require the responsible party to implement the permanent remedy, 6GW.

Support Agency Acceptance

The Support Agency Acceptance factor addresses whether EPA supports, opposes, and/or has identified any reservations with the preferred alternative.

EPA agrees with and supports the selected alternative presented in this ROD.

Community Acceptance

This evaluation factor addresses public reaction to the remedial alternatives which were considered, and the preferred alternative.

Issues raised during the public comment period and at the public meeting held on August 11, 1993 are addressed in the Responsiveness Summary section of this ROD. Comments received during the public comment period indicated that the local residents and Rockaway Township officials supported the preferred alternative for the cleanup of contaminated ground water. RTI submitted extensive comments opposing the Department's preferred alternative (see Responsiveness Summary). Assemblyman Joseph V. Doria, Jr. also commented raising many of the same issues addressed by RTI. Upon review of these comments, DEPE and EPA have determined that no significant changes to the remedy, as it was originally identified in the Proposed Plan, were necessary.

THE SELECTED REMEDY

After careful consideration of the remedial alternatives, DEPE has selected and EPA concurs with an alternative believed to provide the best balance among alternatives with respect to the evaluation criteria for groundwater remediation. The RI/FS reports should be consulted for more information on the remedial alternatives.

While the format for the remedy selection process is in accord with the NCP, the preferred alternatives also are in compliance with the provisions of P.L. 1993, c.139 with respect to the criteria for effectiveness, permanence, implementability, cost, and protection of public health and the environment. DEPE believes the preferred alternatives would be protective of human health and the environment, would comply with remedial action objectives, would comply with state requirements, is the best use of public funds, and would utilize permanent solutions and alternative treatment technologies or resource recovery technologies where appropriate.

Alternative 3GW is the selected alternative to remediate ground water contamination at the RTI Superfund Site. The components of Alternative 3GW are: hydrofracturing and extracting ground water from P-6, R-1 and MW-14D; treating the recovered water with an air stripping system with gases released treated by a vapor phase carbon treatment unit; and, reinjecting the treated effluent to the overburden water bearing zone. The number and disposition of recovery wells may be modified during the design phase.

The goal of the remedial action is to reduce the concentration of VOCs in the most highly contaminated portion of the bedrock aquifer. Based on the information obtained during the RI, it is anticipated that the preferred remedy will achieve this goal. Residual contamination outside the capture zone will dissipate through natural attenuation. State GWQS and federal MCLs will be achieved through a combination of ground water extraction and treatment and natural attenuation. Monitoring of the less contaminated ground water will be conducted to determine if additional remediation is necessary.

Continued sampling of on-site monitor wells, sentinel wells and residential wells will ensure that contaminant concentrations are being reduced on site and that the direction and magnitude of migrating contaminants does not result in an exceedance of state and federal drinking water standards for individual supply wells. Also, there are provisions in this alternative for temporary POET units for residential well users if site-related contamination threatens such wells.

If it is determined during design or implementation that the entire volume of remediated ground water from the RTI capture zone cannot be reinjected into the overburden water bearing zone, other surface water discharge options, or a combination of the above, included in the FS will be considered. Alternative 3GW would be designed to comply with state GWQS and federal MCLs if reinjection to the overburden water bearing zone is used. Promulgated surface water quality standards would apply to surface discharge of treated ground water if that option is used.

The estimated capital cost of this alternative is $486,000. Based on comments received during the public comment period the

Department acknowledges that the estimated capital cost for the selected remedy could be considerably less. The DEPE contractor estimated capital costs for 3GW to be $486,000. However, another estimate of $232,000 submitted as part of a public comment was evaluated by the Department and found to be feasible. A major part of the cost differential was due to a wide variation in well drilling cost estimates.

Based on extracting 10 pore volumes of contaminated ground water in the targeted area, it will take five years to meet the preferred alternative goal. Timeframe estimates for remediating contaminated fractured bedrock aquifers are highly speculative and the actual period of operation may be quite different. Five additional years of sampling monitor and residential wells will be used to confirm the results of the remedial action after the goals of the pump and treat system have been met. Data will then be compared to remediation goals established for this site to identify whether any further action is necessary.

In summary, the selected alternative is believed to provide the best balance among the alternatives with respect to the criteria used to evaluate alternatives. Therefore, based on information available at this time, DEPE and EPA believe the preferred alternative would provide overall protection of health and the environment, and would be cost-effective. This action would use permanent solutions and alternative treatment technologies to the maximum extent practicable, given the scope of the action.

An analyses will be made during the remedial design to ensure that any adverse impacts to any wetland areas will be mitigated. If appropriate, some of the treated groundwater could be discharged to wetland areas to help offset any dewatering effects created by the groundwater extraction.

A Cultural Resource survey will be prepared to ensure compliance with the National Historic Preservation Act.

REMEDIAL GOALS

The goal of the selected remedy is to restore the ground water to the more stringent of the state GWQS and federal MCLs within the zone of capture at the RTI site and to allow residual ground water contamination outside the zone of capture to naturally attenuate. This operable unit will remediate contaminants present in ground water. Based on information obtained during the RI, DEPE and EPA believe that the selected remedy will achieve this goal.

It may become apparent, during implementation or operation of the ground water extraction system, that contaminant levels have ceased to decline and are remaining constant at levels higher than the drinking-water standards over some portion of the contaminated plume. In that case, performance standards and/or the remedy will be re-evaluated.

The selected remedy will include ground water extraction for a period which is presently estimated to be five years (but which, depending upon the degree of contaminant reduction achieved, may ultimately be a longer period), during which the system's performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. Modifications may include any or all of the following:

- Discontinuing pumping at individual wells where cleanup goals have been attained.
- Alternating pumping at wells to eliminate stagnation.
- Pulse pumping to allow aquifer equilibration and to allow adsorbed contaminants to partition into ground water.
- Installing additional extraction wells to facilitate or accelerate cleanup of the contaminated plume.

During the performance of the long-term monitoring, DEPE and EPA may determine that the remedial action objective has been met to the maximum extent practicable. Periodic monitoring will be used to reassess the time frame and the technical practicability of achieving cleanup standards. Upon meeting all remedial objectives, or determining that the Site has been sufficiently purged of contaminants so that public health is no longer threatened by contaminants at the Site, EPA will initiate proceedings to delete the Site from the NPL.

STATUTORY DETERMINATIONS

Remedy selection is based on CERCLA, as amended, and the regulations contained in the NCP and P.L. 1993, c.139 (S-1070). DEPE's primary responsibility is to undertake remedial actions that achieve protection of human health and the environment. Additionally, several other statutory requirements and preferences have been established. These specify that, when complete, the selected remedy must comply with ARARs, unless a statutory waiver is justified. The remedy must also be cost effective and utilize permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable. Finally, there is a preference for remedies which employ treatment that permanently and significantly reduce the toxicity, mobility, or volume of hazardous wastes as their principal element. The following sections discuss how the remedy selected for the RTI site meets these requirements and preferences.

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy protects human health and the environment through the extraction and treatment of contaminated ground water. The extraction and treatment of the contaminated ground water will significantly reduce the threat of potential exposure to contaminated ground water. There are no short-term adverse impacts associated with the selected remedy which cannot be readily controlled. While no cross-media impacts are expected from the remedy, any environmental impacts associated with site-related contaminants or remedial activities will be addressed in the remedial design.

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The selected remedy will comply with all applicable or relevant and appropriate action, chemical and location-specific requirements. The ARARs are presented below.

Action-Specific

The selected remedy will be in compliance with all federal and state ARARs. The cleanup goals for the remediation of the ground water are the more stringent of the promulgated state and federal MCLs which are standards for drinking water.

Emissions from the treatment unit would conform with the provisions of the Clean Air Act. This will be accomplished through the installation of appropriate air pollution control equipment if necessary. Occupational Safety and Health Administration requirements would be complied with during the implementation of the remedy.

With respect to state action-specific ARARs, the air stripper and any other regulated equipment will be designed, constructed, and operated to meet the Air Pollution Control and the Noise Pollution Control Act requirements and regulations.

Chemical-Specific

The more stringent of the state GWQS and federal MCLs will be used as cleanup goals for the ground water remediation.

Location-Specific

The site is not within the coastal zone as defined by the State of New Jersey. Additionally, there are no federally designated wild and scenic rivers and there are no significant agricultural lands in the vicinity of the site. The project area may be sensitive for the discovery of cultural resources. Therefore, as discussed earlier, a cultural resource survey will be prepared during remedial design. Additionally, a wetlands assessment will be performed at that time to determine the potential impacts on wetland areas.

UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

DEPE and EPA have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the RTI site. Of the alternatives that are protective of human health and the environment, and comply with ARARs, the DEPE and EPA have determined that the selected remedy provides the best balance in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, cost, and community acceptance.

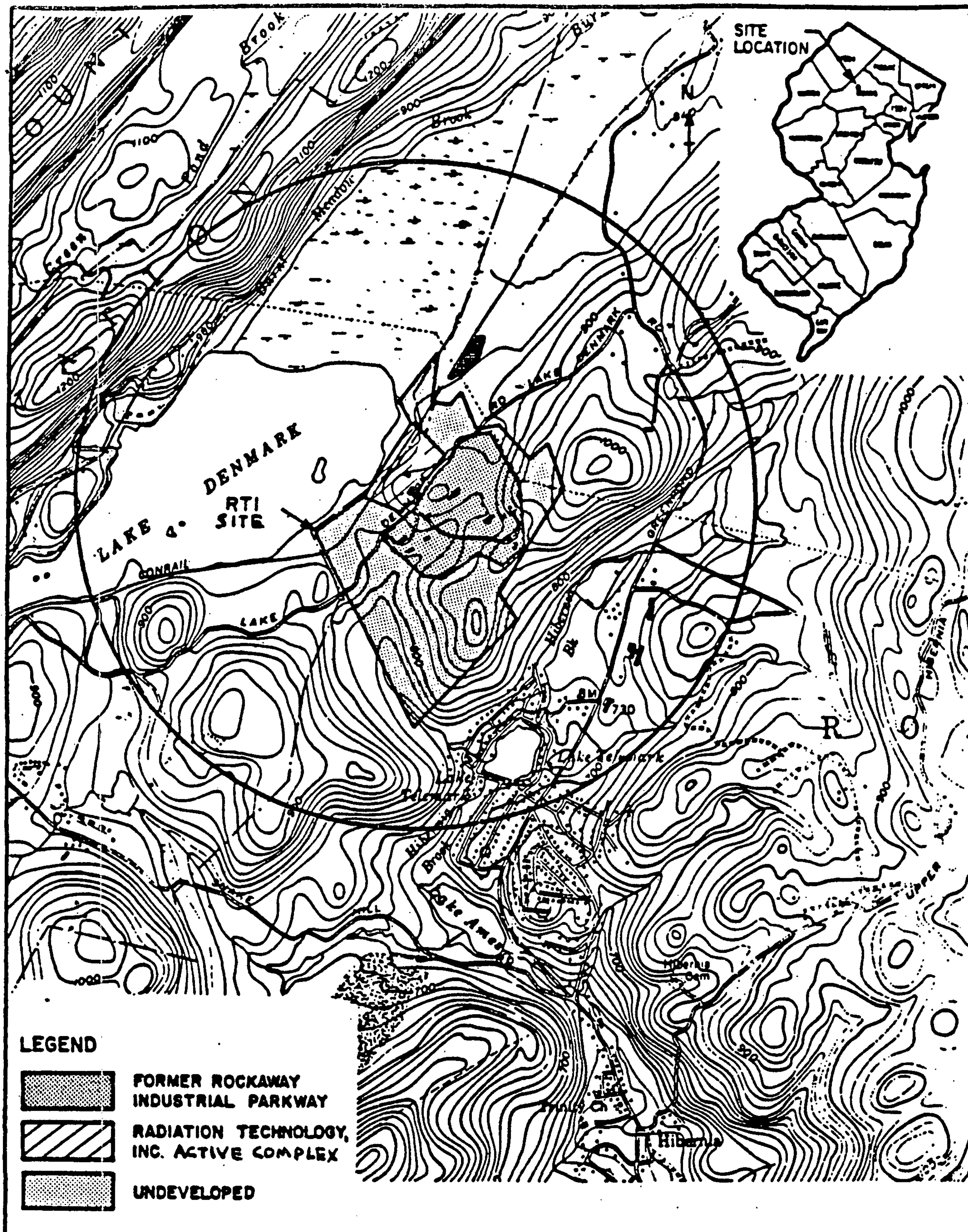
The selected alternative reduces toxicity, mobility, and volume of contaminants in the ground water; complies with ARARs; provides both short-term and long-term effectiveness; and protects human health and the environment. Contaminants in the ground water will be removed and treated. This will significantly reduce the toxicity, mobility and volume of the contaminants, and offer a permanent solution to the risks posed by the contaminated ground water.

COST EFFECTIVENESS

The selected alternative is determined to be cost effective because it provides the highest degree of protectiveness among the alternatives evaluated at reasonable cost.

PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

By extracting and treating the contaminated ground water, the selected remedy addresses the threats posed by the site through the use of treatment technologies. Therefore, the statutory preference for remedies that employ treatment as a principal element is satisfied by the selected remedy.



LEGEND

FORMER ROCKAWAY INDUSTRIAL PARKWAY

RADIATION TECHNOLOGY, INC. ACTIVE COMPLEX

UNDEVELOPED

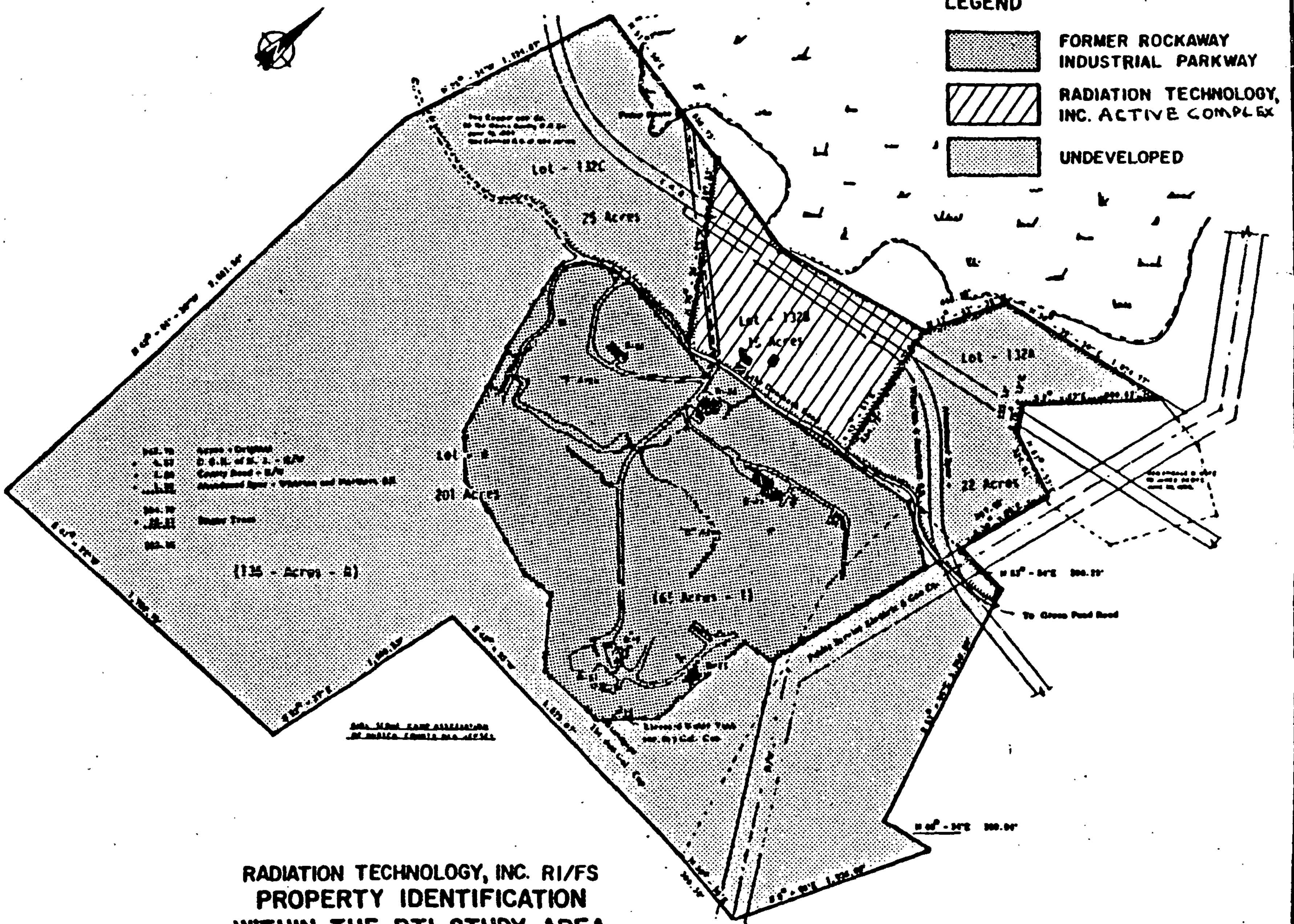
RADIATION TECHNOLOGY, INC. RI/FS

SITE LOCATION MAP

SCALE IN FEET 0 2000 4000

FIGURE 1.1

AGRES



RADIATION TECHNOLOGY, INC. RI/FS
PROPERTY IDENTIFICATION
WITHIN THE RTI STUDY AREA

SOURCE: RTI DRAWING NO. 101, DATE UNKNOWN

FIGURE 1.2

RADIATION TECHNOLOGY INC.
CHEMICAL SUMMARY AND SELECTED ARARs FOR SHALLOW GROUND WATER

Compound	Frequency of Detection	Maximum Detected Value, ug/l	Average Detected Value, ug/l	Federal MCL, ug/l	Practical Quantitation Levels, ug/l	NJDEPE Ground Water Criteria, ug/l
Volatile Organics						
Methylene chloride	1/17	170*J	170*J	5	2	2
Vinyl chloride	1/18	2*J	2*J	–	5	0.08
Acetone	2/15	5,000*	2,715	–	–	700
1,1-dichloroethene	2/17	27	17	5	2	1
1,1-dichloroethane	3/17	74	30	–	–	70
Trans-1,2-dichloroethene	2/17	20	12	–	2	100
Chloroform	1/18	8	8	100	1	6
1,1,1-trichloroethane	3/14	51	21	200	1	30
Carbon tetrachloride	2/18	87	46	–	2	0.4
Trichloroethene	5/17	120	38	1.7	1	1
1,1,2-trichloroethane	1/18	14	14	–	2	3
4-methyl-2-pentanone	2/18	22*	12	–	–	400
Tetrachloroethene	1/18	5	5	5	1	0.4
Trichlorofluoromethane	2/13	4*	3	–	–	2,000
Semi-volatile Organics						
Bis-(2-ethylhexyl)phthalate	2/5	3,504	3,143	4	30	3
Endosulfan sulfate	1/5	0.24	0.24	–	0.08	0.4
Inorganics						
Aluminum	2/2	3,380	2,345	50-200	200	200
Barium	2/2	36*C	33	2,000	200	2,000
Calcium	2/2	16,700	11,365	–	–	–
Chromium (total)	1/2	167*	167	100	10	100
Copper	2/7	99	56	1,000	1,000	1,000
Iron	2/2	8,260*	5,820	300	100	300
Lead	2/7	20	18	15	10	5
Magnesium	2/2	4,250*C	3,275	–	–	–
Manganese	2/2	195	182	50	6	50
Nickel (Soluble salts)	1/2	94	94	100	10	100
Potassium	2/2	2,190*C	1,720	–	–	–
Silver	2/7	12	10	50	2	–
Sodium	2/2	6,780*	5,505	–	400	50,000
Vanadium	1/2	7*C	7	–	–	–

Notes:
(1) – no value established
(2) Number of samples does not include rejected or blank contamination samples
(3) Federal MCLs are National Primary Drinking Water Regulations; Final Rule 1991
(4) NJDEPE Ground Water Standards are NJAC 7:9-6
(5) Where NJDEPE Practical Quantitation Level (PQL) is higher numerically than the NJDEPE Ground Water Standard, the PQL becomes the standard

RADIATION TECHNOLOGY INC.
CHEMICAL SUMMARY AND ARARs FOR SELECTED DEEP GROUND WATER

Compound	Frequency of Detection	Maximum Detected Value, ug/ℓ	Average Detected Value, ug/ℓ	Federal MCL, ug/ℓ	Practical Quantitation Levels, ug/ℓ	NJDEPE Ground Water Criteria, ug/ℓ
Volatile Organics						
Methylene chloride	4/37	79*	27	5	2	2
Vinyl chloride	2/41	99*	73	–	5	0.08
Acetone	3/34	7,600*	3,523	–	–	700
1,1-dichloroethene	7/42	21*	12	5	2	1
1,1-dichloroethane	9/42	79*	27	–	–	70
2-butanone	1/42	19*	19	–	–	–
1,2-dichloroethene	6/42	130*	40	–	2	100
Chloroform	2/42	10*	6	100	1	6
1,1,1-trichloroethane	19/41	950*	124	200	1	30
Carbon tetrachloride	5/41	140	54	–	2	0.4
Trichloroethene	16/42	140	21	1.7	1	1
1,1,2-trichloroethane	1/42	6	6	–	2	3
Benzene	1/42	3.8J	3.8	5	1	0.2
4-methyl-2-penthanone	1/42	4.3J	4.3	–	–	400
Tetrachloroethene	1/42	4.2*J	4.2	5	1	0.4
Toluene	2/42	2.7*J	2.4	1,000	5	1,000
Ethylbenzene	2/42	510*	359	700	5	700
Trichlorofluoromethane	4/28	283*	145	–	–	2,000
1,1,2-trichlorofluoro-1,2,2-trifluoroethane	4/28	5,000*	2,010	–	–	20,000
Isomer of dichloroethene	1/29	10*	10	–	–	–
Chlorofluoroethene	1/29	6*	6	–	–	–
Semi-volatile Organics						
2-Chlorophenol	1/19	45*	45	–	20	40
Di-n-octylphthalate	1/19	7J	7	–	–	100
4-chloro-3-methylphenol	1/19	18	180	–	20	–
Di-n-butylphthalate	4/19	16J	9	–	20	900
Bis-(2-ethylhexyl)phthalate	2/19	887	663	4	30	3
Beta-BHC	1/19	0.03*J	0.03	–	0.04	0.2

RADIATION TECHNOLOGY INC.
CHEMICAL SUMMARY AND ARARs FOR SELECTED DEEP GROUND WATER

Compound	Frequency of Detection	Maximum Detected Value, ug/ℓ	Average Detected Value, ug/ℓ	Federal MCL, ug/ℓ	Practical Quantitation Levels, ug/ℓ	NJDEPE Ground Water Criteria, ug/ℓ
<u>Inorganics</u>						
Aluminum	5/6	366	171	50-200	200	200
Arsenic	1/6	1.8°C	1.8	50	8	0.02
Barium	1/6	16°C	16	2,000	200	2,000
Calcium	6/6	69,900	21,518	–	–	–
Copper	5/19	10	66	1,000	1,000	1,000
Cyanide	1/19	11.9	12	200	40	200
Iron	4/6	1,730°	1,169	300	100	300
Lead	3/19	14.1	10	15	10	5
Magnesium	6/6	12,700	5,147	–	–	–
Manganese	6/6	398	92	50	6	50
Nickel (~~Soluble salts~~)	1/6	8°C	8	100	10	100
Potassium	5/6	2,030°C	1,492	–	–	–
Silver	2/19	25J	22	50	2	–
Sodium	6/6	13,200°	7,265	–	400	10,000
Vanadium	1/2	7°C	7	–	–	–
Zinc	3/13	136	72	5,000	30	5,000

Notes:
(1) – no value established
(2) Number of samples does not include rejected or blank contamination samples
(3) Federal MCLs are National Primary Drinking Water Regulations; Final Rule 1991
(5) NJDEPE Ground Water Standards are NJAC 7:9-6
(6) Where NJDEPE Practical Quantitation Level (PQL) is higher numerically than the NJDEPE Ground Water Standard, the PQL becomes the standard
(7) Well P-6 pump test and residential well data not included

TABLE 2.1

SUMMARY OF CARCINOGENIC RISK ESTIMATED FOR THE RADIATION TECHNOLOGY SITE

SCENARIO	RECEPTOR	PRESENT/FUTURE	TOTAL RISK
GROUND WATER - CHEMICAL CONTAMINANTS			
Ingestion	Resident	F	$2x10^{-3}$**
Dermal Contact	Resident	F	$1x10^{-4}$*
Inhalation	Resident	F	$2x10^{-4}$*
		Total	$2x10^{-3}$**

*Exceeds 10^{-6} risk

**Exceeds 10^{-4} risk

TABLE 2.2

SUMMARY OF NONCARCINOGENIC RISK ESTIMATED FOR THE RADIATION TECHNOLOGY SITE

Scenario	Receptor	Present/Future	Chronic HI
GROUND WATER-CHEMICAL CONTAMINANTS			
Ingestion	Resident	F	$5x10^{+0}$*
Dermal Contact	Resident	F	$7x10^{-1}$*
Inhalation	Resident	F	$4x10^{-1}$
		Total	$5x10^{+0}$*

* - HI exceeds one (1)

Summary of Costs of Alternatives

Ground Water Remediation

Alternative	Description	Estimated Costs	Time to Complete
1GW: No Action	• Establishes a baseline for comparison with other alternatives • Five-year site review	Capital: $0 Annual O&M: $0 Present Worth: $41,000	none
2GW: Institutional Control	• Sampling of sentinel well system • Sampling of site monitor wells • Sampling of selected residential wells • Site review every five years	Capital: $228,000 Annual O&M: $94,000 Present Worth: $2,122,000	30 years
*3GW: Ground Water Collection with Hydrofracturing and Air Stripping Treatment	• Sampling of sentinel well system • Point-of-entry treatment provisions • Hydrofacturing • Air stripping with vapor phase carbon adsorption treatment • Discharge of treated effluent to overburden water bearing zone • Monitoring	Capital: $486,000 Annual O&M: $140,000 (Years 1 to 5) Annual O&M: $108,000 (Years 6 to 10) Present Worth: $1,963,000	10 years
4GW: Ground Water Collection with Hydrofracturing and Hydrogen Peroxide/Ultra Violet Treatment	• Sampling of sentinel well system • Point-of-entry treatment provisions • Hydrofacturing • Hydrogen Peroxide/UV treatment with vapor phase carbon adsorption treatment • Discharge of treated effluent to overburden water bearing zone • Monitoring	Capital: $704,000 Annual O&M: $233,000 (Years 1 to 5) Annual O&M: $108,000 (Years 6 to 10) Present Worth: $2,800,000	10 years

* Selected Remedy

(Continued)

Summary of Costs of Alternatives

Ground Water Remediation

Alternative	Description	Estimated Costs	Time to Complete
5GW: Ground Water Collection and Air Stripping Treatment without Hydrofacturing	• Sampling of sentinel well system • Point-of-entry treatment provisions • Air stripping with vapor phase carbon adsorption treatment • Discharge of treated effluent to overburden water bearing zone • Monitoring	Capital: $457,000 Annual O&M: $128,000 (Years 1 to 9) Annual O&M: $108,000 (Years 6 to 10) Present Worth: $2,241,000	14 years
6GW: Complete Aquifer Restoration with Hydrofracturing and Air Stripping Treatment	• Sampling of sentinel well system • Point-of-entry treatment provisions • Hydrofacturing • Air stripping treatment with vapor phase carbon adsorption treatment • Discharge of treated effluent to overburden water bearing zone • Monitoring	Capital: $1,015,000 Annual O&M: $207,000 (Years 1 to 14) Annual O&M: $108,000 (Years 15 to 19) Present Worth: $4,445,000	19 years

over...

Responsiveness Summary
Radiation Technology Incorporated Superfund Site

This responsiveness summary is divided into the following sections:

A. Overview
B. Summary of comments received during the public comment period and DEPE/EPA response
   -- Part I: Summary of local community concerns
   -- Part II: Comprehensive response to specific technical questions
C. Appendices

A. Overview

This Responsiveness Summary details public comments and concerns regarding the proposed remediation for contaminated ground water at the Radiation Technology Incorporated (RTI) Superfund site. A public comment period was held from July 30 to September 27, 1993 to provide parties the opportunity to comment on the Proposed Plan, Remedial Investigation (RI) report, Feasibility Study (FS) report, and other supporting documents related to the RTI site. During the comment period the New Jersey Department of Environmental Protection and Energy (DEPE) held a public meeting on August 11, 1993 at 7 p.m. at the Rockaway Township Municipal Building to discuss results of the RI/FS and to present a preferred alternative for remediation of contaminated ground water.

B. Summary of Comments Received During the Public Comment Period and DEPE/EPA Response

Comments received during the public comment period from the local community focused primarily on private residents' concerns about their potable water supply, notifying more residents who live near the site about actions related to remedial activity and support for the preferred alternative. The responsible party's (RTI) primary comments focused on its findings that an active ground water treatment system is unnecessary and that natural attenuation and monitoring will be an effective and less costly remedy. The responsible party also commented that the health risk to area residents from site ground water contamination is overstated as no potable, off-site wells have been impacted to date.

Part I: Summary and response to local community concerns

Comment: Two residents expressed concern about potential ground water contamination affecting their drinking water and requested to be included in any future sampling of potable wells around the RTI site.

Response: The DEPE sampled five residential potable wells during the RI in the vicinity of the these concerned residents. None of these five wells were impacted. This information was shared with the two residents who commented. Also, they were informed that the DEPE will evaluate if it is necessary to monitor their potable wells during implementation of the selected alternative. Finally, DEPE recommends that residents with private potable wells have their water tested annually or on a periodic basis following the advice of the Rockaway Township health officer.

Comment: One resident (in the Lake Telemark neighborhood) near the southeastern, undeveloped side of the RTI site expressed concern that he received notice of the August 11, 1993 public meeting in the mail only one day before the meeting was scheduled to be held and that it was the first time he had heard about contamination at the RTI site since moving to the community in 1984.

Response: Residents along Lake Denmark Road, who are closer to the active RTI portion of the site, were notified two weeks prior to the public meeting. Historically, DEPE has primarily dealt with residents and developers concerned about properties along Lake Denmark Road. Residents of the Lake Telemark area were mailed public meeting notices only a few days before the meeting after their names were added to DEPE's mailing list as a result of information requested by the Department and received from the Rockaway Township Health Department. Rockaway Township officials also received notice of the public meeting two weeks prior through the mail and more than a month prior through telephone conversations. Finally, a newspaper advertisement announcing the public meeting date and preferred alternative was published in the July 30, 1993 edition of the "Daily Record" (Morristown). DEPE regrets that the mailing list was not expanded and updated earlier for residents in the Lake Telemark community. DEPE will work with the Rockaway Township Health Department to further expand its mailing list in the Lake Telemark community so that its residents will receive timely notice of major site activities.

Comment: One resident stated that children can enter the RTI site on the eastern side of the property line through many large holes in an existing fence. This resident requested that warning signs be put up on the fencing around the site to keep unsupervised children from entering the property.

Response: DEPE will discuss with the responsible party this request to secure the fencing around the site and to post appropriate warning signs.

Comment: Assemblyman Joseph V. Doria Jr. requested that DEPE consider RTI's position that an active ground water treatment system is unnecessary and requested that the Department change the preferred alternative to Alternative 2GW.

Response: DEPE provides responses to Mr. Doria's comments in Part II: Comprehensive Response to Specific Technical Questions as they are similar to comments received from the responsible party itself.

Comment: Rockaway Township Health Officer Steve Levinson provided comments in support of the preferred Alternative 3GW and requested that DEPE continue to involve his office in future sampling events of residential potable wells.

Response: DEPE will continue to work with the Rockaway Township Health Department to coordinate private potable well sampling events in the future and ensure the results are forwarded to the health officer for appropriate action.

Part II: Comprehensive Response to Specific Technical Questions

Comment: RTI does not agree that provisions for the potential presence of a Dense Non-Aqueous Phase Liquid (DNAPL) should be included as a factor in the remedial alternatives considered in the FS.

Response: Freon-113, a DNAPL, is present and is a site-related contaminant. The highest concentration of Freon-113 in ground water to date is 13,000 micrograms per liter (ug/L or parts per billion). While this concentration is below the health based criteria developed by DEPE consistent with state Ground Water Quality Standards (NJAC 7:9-6) (GWQS), the Department is concerned with the possibility that Freon-113 exists in the bedrock aquifer in concentrations indicative of free product. The aqueous solubility of Freon-113 is 136,000 ug/L. Freon-113 has a specific gravity of 1.56. According to EPA's January 1992 publication 9355.4-07FFS entitled "Estimating

Potential Occurrence of DNAPL at Superfund Sites" a compound need only approach one percent of its aqueous solubility to be suspected of being present as free product. At the RTI, site Freon-113 has reached 10 percent of its aqueous solubility. DEPE believes that the area containing the highest concentrations of Freon-113, in the area of well P-6, should be hydraulically controlled as a contaminant source control measure. Furthermore, additional remedial measures for collecting any identified free product may be implemented.

Comment: RTI disagrees with the Proposed Plan statement "The bedrock aquifer which underlies the RTI property serves as a sole drinking water source for area residents. For this reason, complete aquifer remediation was considered as an alternative."

Response: The aquifer below the RTI site is the sole or principle source of drinking water for the population in the region. In addition, this aquifer (the Highlands Aquifer System) is classified as Class IIA per N.J.A.C. 7:9-6 et seq. This classification identifies the ground water as a primary drinking water source in the State of New Jersey.

Comment: RTI states that the Risk Assessment future use scenarios are too conservative and inappropriate for the RTI site.

Response: The future use scenarios as presented in the Risk Assessment are appropriate for this site as required under EPA guidance. This is primarily because it is possible that the site or surrounding area could be developed in the future for residential use and that such development may involve the installation of drinking wells. Also, in accordance with P.L. 1993, c.139, DEPE addresses permanent remedies at contaminated sites. And even if a permanent remedy is not selected, removal of a ground water contamination source is consistent with EPA's Office of Solid Waste and Emergency Response Directive 9236.2-25 "Guidance for Evaluating the Technical Impracticability of Ground Water Restoration." Finally, the selected remedy complies with the provisions in P.L. 1993, c.139, Section 35g that a permanent remedy (6GW) that costs 50 percent or more than a nonpermanent remedy will not be selected.

Comment: RTI stated that there is no evidence that ground water discharge is occurring from the bedrock to Lake Denmark and that a dilution calculation should be used to determine ground water contaminant impacts to surface water.

Response: Sampling data indicates that sediments in Lake Denmark are contaminated at low levels with site-related contaminants. The presence of these contaminants, while not considered a problem for the lake at the present time, indicates that ground water is most likely discharging to the lake. In addition, there is hydraulic head evidence as well as topographic evidence that ground water is discharging to Lake Denmark. DEPE does not accept dilution calculations for determining ground water impacts to surface water since ground water may impact organisms prior to dilution. Typically, DEPE compares ground water samples from the wells closest to potentially-impacted water bodies (in this case Lake Denmark) directly to federal or state in-stream criteria. Also, DEPE compares these ground water samples to remedial discharge criteria derived from the Department's "Technical Manual for Discharges to Surface Water" (July 1993).

Comment: RTI states that DEPE did not seriously consider institutional controls, natural attenuation and sentinel monitoring as an alternative for ground water remediation of the RTI site.

Response: DEPE considered and thoroughly evaluated institutional controls, natural attenuation and sentinel monitoring in the Feasibility Study. DEPE's preferred alternative includes natural attenuation as an integral part of the remedy. Specifically, natural attenuation will be effective in the bedrock aquifer throughout most of the site except for the area around well P-6. A pump and treat system is required in the area of well P-6 to control the source of ground water contamination. There are several reasons that the area around well P-6 must be actively treated. First, the concentration of 1,1,1 trichloroethane (1,1,1 TCA) has averaged more than 1,000 ug/l in well P-6 during the last 12 years. This average concentration is more than 35 times higher than the state GWQS for a Class II-A aquifer. Second, this well contains levels of Freon indicative of free product and is one of three proposed extraction wells. Third, other contaminants found in production and monitor wells exceed Class II-A standards by one to two orders of magnitude. One proposed extraction well, 14-D, contains vinyl chloride at 99 ug/l, which is above the 0.08 ug/l state GWQS. A third well is proposed to be a new extraction well installed to create a desired cone of depression in the hot spot area. These wells are only proposed and are subject to change based on the actual design.

The Department only considers a natural remediation system if all sources of contamination and free product have been controlled. The Department believes that there is a potential that Freon-113 free product exists in the bedrock aquifer at this site. The fact that 1,1,1 TCA concentrations have not significantly decreased for more than a decade may indicate that a source of 1,1,1 TCA exists as well. In addition, contaminants present must not exist in concentrations that are expected to impact an ecological receptor above applicable standards. In this case, the state or federal in-stream criteria and state remedial discharge criteria would be the applicable standard in monitor wells close to Lake Denmark before dilution occurs. Finally, the selected remedy has a lower cost than Alternative 2GW, solely a monitoring and natural attenuation alternative.

Overall, data indicates that product is present in the fractured bedrock below the water table. Alternative 3GW would contain and monitor this product in the most contaminated area and allow the rest of the site to attenuate naturally.

Comment: RTI contends contaminant concentrations are decreasing all across the site.

Response: A comparison of data from 1987 to 1992 shows that most contaminants of concern remained fairly constant or slightly increased. Hence, current data are not sufficient to establish a definite downward trend. If source removal is complete and there are no residual sources in the aquifer, then contaminant levels should naturally attenuate with time. However, the Department believes that product sources still exist in the bedrock aquifer that need to be remediated.

Comment: RTI states that the Department has "dismissed" ground water quality sampling in the overburden and that the proposed plan does not rely heavily upon this data.

Response: The Proposed Plan does rely upon overburden ground water quality data to make the determination that natural attenuation should be effective in the overburden water bearing zones as noted in the preferred alternative. Continued monitoring of the overburden aquifer is an integral part of the preferred alternative to be employed at the RTI site.

Comment: RTI states that existing ground water contamination can flow only in a northwesterly direction.

Response: The Department disagrees with this statement. The RTI site is situated on a hydrogeologic divide and ground water may migrate in a number of directions. Also, ground water located at well P-2 (a contaminated well located on or near this ground water divide) can migrate in a southeasterly direction towards on-site wetlands and a stream which discharges to Lake Telemark. Also, ground water contamination has already migrated to well MW-18D which is southwest of well P-6 and well MW-14D (the presumed source area). In addition, this statement does not consider that the aquifer is fractured bedrock. Ground water will migrate in a preferred direction along fracture strikes in a bedrock aquifer.

Comment: RTI states that it is already engaged in remediation by pumping and treating one of its wells, P-2, in order to use the water for sanitary purposes.

Response: DEPE disagrees with RTI that its current minimal pumping of well P-2 is an effective ground water remedy. Levels of VOCs in well P-2 are about one third to one half the those detected in well P-6, one of three extraction wells proposed as part of Alternative 3GW. Natural attenuation will be a sufficient remedy for the area around well P-2. Pumping well P-2 does not capture the contaminant source area because its hydraulic influence is insufficient.

Comment: RTI challenges DEPE's capitol cost estimate for implementing the preferred alternative and contends that it can implement the remedy for less money than the state.

Response: DEPE's capital cost estimate is more than $200,000 above RTI's estimate. Most of the difference occurs in the drilling costs of new wells or expansion of existing wells. DEPE agrees that RTI can implement the preferred alternative for less cost than presented in the Proposed Plan.

Comment: RTI commented on the proposed number, depths and locations of sentinel wells.

Response: Pursuant to the state ACO, RTI will propose the sentinel monitoring system for DEPE review during design.

Comment: RTI suggests removing well RW-4 and well RW-5 from the list of wells which will be monitored as part of protection of human health. RTI also suggests that wells RW-1, RW-2 and RW-3 should be sampled only once and then the sentinel well system be allowed to take over to protect these wells from potential contaminants. Lastly, RTI suggests that the list of analytes for the residential well sampling be restricted to site related contaminants of concern as defined by the Proposed Plan.

Response: Pursuant to the state ACO, RTI will propose a residential well monitoring system and protocol for DEPE review during design.

Comment: RTI suggests that "ground water contamination" be defined as the contaminants of concern used for the risk assessment.

Response: Ground water contaminants are defined by those constituents detected in the ground water that exceed state GWQS and federal MCLs.

Comment: RTI suggests that hydrofracturing not be used for the purpose of remediation because contaminants may be spread through the aquifer.

Response: Pursuant to the state ACO, RTI will evaluate the use of hydrofracturing during design for DEPE review when aquifer pumping tests will be performed. After hydraulic data are collected and aquifer characteristics are better known, a determination can be made concerning the appropriateness of hydrofracturing the aquifer.

Comment: RTI suggests that pulse pumping may not be an effective means to control ground water contamination.

Response: Pursuant to the state ACO, RTI will propose the frequency of pumping in design. The system will be designed to control the most significant area of contamination.

Comment: RTI states that methylene chloride and acetone data should not be mentioned due to the presence of these contaminants in sample blanks.

Response: DEPE believes that acetone and methylene chloride are present in the ground water at the RTI site. Although acetone and methylene chloride were found in ground water samples and laboratory blanks, the concentrations at which these compounds were detected in ground water were much higher than would be expected from laboratory contamination alone. Therefore, the Department believes that these compounds are present in the ground water at the site. The fact that acetone and methylene chloride have been detected was not a key factor into the final decision to perform an active remediation at the site.

Comment: RTI noted "The analytical data are reported by Acres as not yet having been validated."

Response: All data has now been validated by DEPE.

Comment: RTI commented "Of the VOCs detected, many of the detections are J-values resulting from large dilution factors and may not, in fact, be accurate."

Response: RTI's suggestion that J values should not be included is not valid. When values are "J'd," it simply indicates a quantitative estimate. Qualitatively, the compound is present and cannot be ignored.

Comment: RTI states that the saprolite layer is a very effective confining layer between overburden and bedrock, along Lake Denmark.

Response: The data collected in the RI do not support this conclusion. Data indicate that the saprolite layer is not continuous along Lake Denmark. Therefore, it cannot act as an effective confining unit along Lake Denmark except in localized areas.

Comment: RTI states that the bedrock is not heavily fractured, and the 350 feet deep production well will only support pumping of 29 gallons per minute. RTI further states "this observed <u>specific capacity</u> is consistent with a range of hydraulic conductivities for the bedrock of about $2x10^{-4}$ to $2x10^{-5}$ $ft^3/ft^2/min$."

Response: DEPE believes that there is insufficient data to accurately determine hydraulic conductivity at this time. Pursuant to the state ACO, RTI will perform aquifer pumping tests during design. If it is determined that a pumping rate can not be achieved to contain the area of highest ground water contamination, RTI will propose measures to increase conductivity in the aquifer (i.e.

hydrofracturing) for DEPE review.

Comment: RTI requested a copy of the public meeting transcript and slides used for the presentation by DEPE and its contractors.

Response: A copy of each document is attached to the Responsiveness Summary.

C. Appendices

Appendix 1.	Proposed Plan
Appendix 2.	Public notice that appeared in the "Daily Record" (Morristown)
Appendix 3.	Public meeting transcript
Appendix 4.	Slides used at public meeting by DEPE and its contractors
Appendix 5.	Written comments submitted during the public comment period

Tony

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION II
26 FEDERAL PLAZA
NEW YORK, NEW YORK 10278

RECEIVED
APR - 6 [redacted]
COMMISSIONER

MAR 30 1994

Robert C. Shinn, Jr., Commissioner
State of New Jersey
Department of Environmental
Protection and Energy
401 East State Street
Trenton, New Jersey 08625

Dear Commissioner Shinn:

The U.S. Environmental Protection Agency (EPA) has evaluated and concurs with the remedy recommended by the New Jersey Department of Environmental Protection and Energy (NJDEPE) for remediation of ground water contamination at the Radiation Technology Incorporated Superfund site in Rockaway Township, Morris County, New Jersey.

The remedy, which consists of Alternative 3GW described in the February 1993 Feasibility Study report and the July 1993 Proposed Plan, addresses the current and future threats to human health and the environment associated with contaminated ground water at the site. The need for remediation of contaminant sources will be addressed in a subsequent decision document. The major components of the ground water remedy include:

- Restoration of the contaminated ground water to the more stringent of the federal and New Jersey Safe Drinking Water Act Maximum Contaminant Levels (MCLs) and New Jersey Ground Water Quality Standards, through extraction of the more highly contaminated ground water and natural attenuation of residual ground water contamination;

- Treatment of the extracted ground water to levels attaining the more stringent of the federal and New Jersey MCLs and New Jersey Ground Water Quality Standards;

- Reinjection of treated ground water; and

- Appropriate environmental monitoring to ensure the effectiveness of the remedy.

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The Record of Decision (ROD) which NJDEPE provided to EPA evaluated several alternatives in the remedy-selection process. These included a no action alternative (Alternative 1GW); an institutional control alternative (2GW); three alternatives in which contamination from the more highly contaminated portion of the contaminant plume would be extracted, with natural attenuation of residual contamination (3GW, 4GW, and 5GW); and an alternative involving the active restoration of the entire contaminated bedrock aquifer (6GW).

Although EPA agrees with the remedy recommended by NJDEPE (i.e., Alternative 3GW), EPA does not fully concur with the rationale reflected in the ROD for selection of that alternative. In particular, EPA disagrees with NJDEPE's use of the Industrial Site Recovery Act in the remedy selection process.

As you are aware, the methodology for identifying applicable or relevant and appropriate requirements (ARARs) and the remedy selection process for sites addressed under the Comprehensive Environmental Response, Compensation and Liability Act as amended (CERCLA) are set forth in the National Contingency Plan (NCP). It is EPA's view that the identification of ISRA as an ARAR and as a basis for rejecting or recommending any remedial action alternative is not in accord with the NCP and, therefore, EPA cannot fully concur in the rationale used by NJDEPE to identify Alternative 3GW as the selected remedy. EPA, however, does believe that Alternative 3GW is an acceptable remedy under the NCP. The reasons for that conclusion are set forth below.

All of the active restoration alternatives (3GW through 6GW) appear to be protective of human health and the environment; to comply with applicable or relevant and appropriate requirements; and to reduce the toxicity, mobility, and volume of contamination through treatment. All three active remediation alternatives also appear to provide short-term and long-term effectiveness, and permanence.

It is recognized that because Alternatives 3GW, 4GW, and 5GW rely on the natural attenuation of residual contamination, Alternative 6GW might result in the achievement of cleanup goals in a shorter time period than the others. However, due to the complex nature of the bedrock aquifer at the Radiation Technology site, as well as the wide dispersion of contaminants, the technical feasibility of complete aquifer restoration as envisioned in Alternative 6GW is questionable. Further, it is believed that the selected remedy, Alternative 3GW, will result in the cost-effective extraction and treatment of a majority of the contaminants that are estimated to pose a significant risk under future-use scenarios, while cleanup objectives would be attained for the less-contaminated ground water through natural attenuation processes. The selected remedy also provides for monitoring of the less-contaminated ground water to determine if additional active remediation will be necessary. Therefore, EPA has concluded that Alternative 3GW is the appropriate CERCLA remedy for ground water at the site.

The selected remedy is consistent with the preferred alternative described in the Proposed Plan including the need to address the remediation of site soils and other contaminant sources in a subsequent ROD. Since the remedy will result in hazardous substances remaining on the site above health-based levels, a review will be conducted within five years after commencement of the remedial action to ensure that it continues to provide adequate protection of human health and the environment.

We look forward to working with NJDEPE toward the remediation of the Radiation Technology site. If you have any questions, or would like to discuss this matter further, please do not hesitate to contact me.

Sincerely,

William J. Muszynski, P.E.
Acting Regional Administrator